THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

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THE PARIS ELECTRICAL EXHIBITION.

THE BRITISH SECTION.

ELLIOTT BROTHERS.

(Continued from page 374.)

"FIRING RHEOSTAT." This instrument, which is of the Government pattern, is used in two ways, viz., with or without the bridge; in the latter case it forms an ordinary set of resistance coils, and in the former, a bridge with 10 ohms in the "ratio" branches. When the apparatus is used as a firing rheostat, a platinum wire of a definite thickness is clamped between two pillars which are exactly $\frac{1}{4}$" apart; the current which is to be used for firing fuzes is sent through the resistance coils and the platinum wire first, and then the resistances are varied until the platinum becomes heated white hot.

"OIL-VESSEL GALVANOMETER" (wrongly called so, because generally distilled water is used for damping the oscillations of the needle). This instrument is also a Government pattern; the coils contain fine and stout wire, one having 2,000 ohms, the other $\frac{1}{4}$ ohm resistance. The mirror has a diameter of $\frac{3}{4}$ inch, and the magnet a similar length. The two are mounted on a platinum stem, which has a loop at its lower end for holding a platinum vane, which latter is simply hooked on. A switch at the left of the instrument facilitates the changing from high to low resistances and *vice versâ*. A shunt box is also provided for the high resistance, and is easily connected.

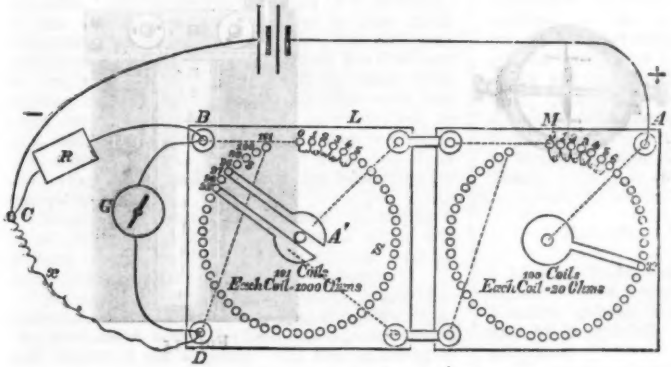
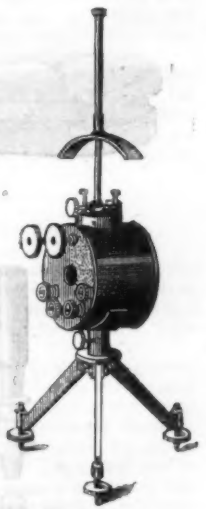


FIG. 10.

FIG. 11.



11a.

FIG. 13.

"SLIDING COILS." (Figs. 10 and 11.) The portion, L, of this apparatus (fig. 10) has two revolving arms fixed parallel to each other, and embracing two coils. The current from one pole of the battery enters this double arm at A', passes along it, and is

divided in the two branches, S and s. If the arm is moved one division to the right, S is increased, and s is decreased by 1,000. For finer adjustment the current is divided in the coils, M. As shown by fig. 10, the resistances in the two "ratio" arms of the bridge are S = 95680, and s = 4320.

"DIFFERENTIAL REFLECTING TRIPOD GALVANOMETER, LOW RESISTANCE." This instrument differs from the others by having, in place of copper wire, a silk-covered copper *band*. Each coil is mounted on a dovetail, moved by a screw from the back. The copper band has a decided advantage over the copper wire, especially for low resistance, as it brings the convolutions much nearer the needle.

"REFLECTING TRIPOD GALVANOMETER, HIGH RESISTANCE." (Fig. 11a.) This is a very portable and a very sensitive instrument, it has a very light astatic needle.

"REFLECTING WOOD CASE GALVANOMETER," differs from the previously described instrument in two points; it has for cheapness sake a mahogany case and a long silk suspension inside the tube on which the directing magnet moves up and down. The needle is astatic, but has no aluminium vane. A very good instrument.

"ROUND BRASS CASE ASTATIC GALVANOMETER, GLASS CYLINDER, AND SQUARE CASE GALVANOMETER." These are all three essentially the same, the difference being only in the outer cases. The delicately-suspended light astatic needle, with its $\frac{3}{8}$" mirror, is inclosed by four coils of copper wire, of which two act on the upper and the other two on the lower of the astatic needle. The needle has 10 light magnets. The two upper and the two lower coils of wire are connected with four terminals, to enable the experimenter to join the coils in series, or in multiple arc.

"SIMPLE MAGNETOMETER," is constructed to observe the deflections of a delicately-suspended mirror and magnet, either caused by terrestrial magnetism or other influences.

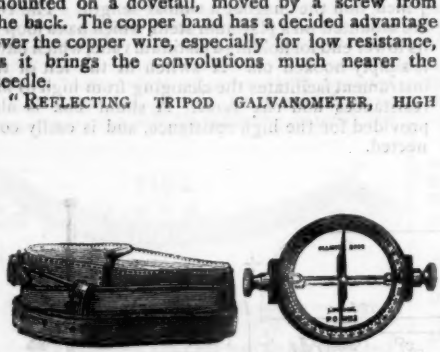


FIG. 14.

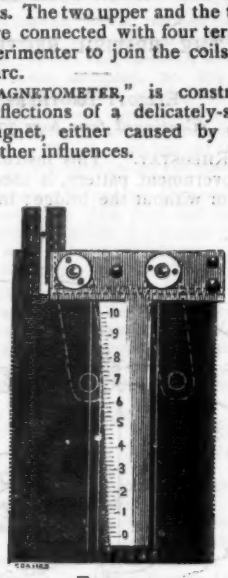


FIG. 15.

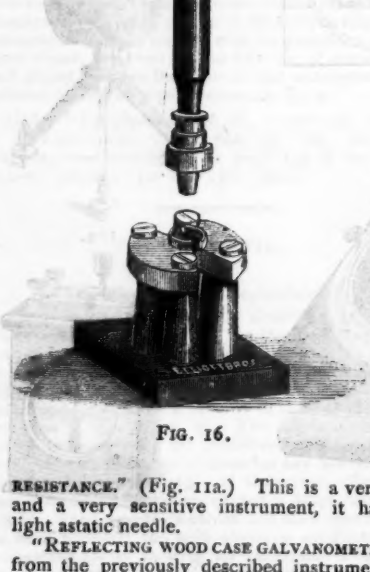


FIG. 16.

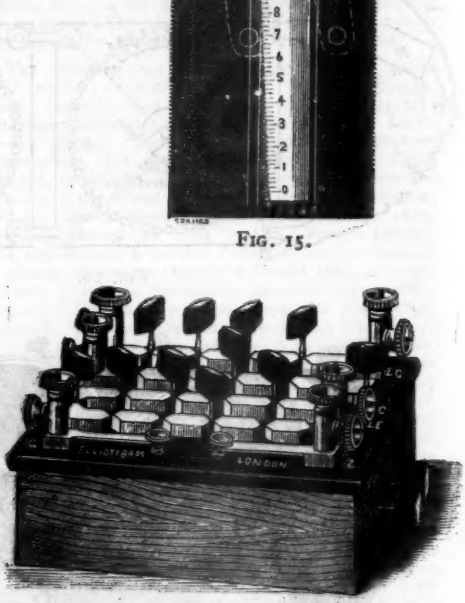


FIG. 12.

"POST-OFFICE SET OF RESISTANCE COILS" (fig. 12), with switch at the side, the well-known type with resistances from 1 to 4,000 ohms, and 10, 100, and 1,000 ohms in the bridge ratio. The switch or commutator at the side reverses the "line" and "earth" connections, so that either positive or negative currents can be sent to line, whilst the deflection of the galvanometer needle due to, say, too much resistance being in the adjustable arm of the bridge, is always in the same direction.

"SMALL REFLECTING GALVANOMETER." The needle in this instrument is not astatic, but the influence of earth's magnetism is neutralised by the directing magnet. The needle is suspended in a brass tube. The coil consists of stout wire.

"BROWN'S DETECTOR" (fig. 13) is an ordinary vertical galvanometer; but the coil has three sections, of 2, 10, and 1,000 ohms respectively.

"PORTABLE ASTATIC GALVANOMETER." The chief feature of this galvanometer (which is shown by fig. 14) is its portability. The resistance is 1,000 ohms, and the astatic needle is pivotted in jewelled holes to reduce friction. The galvanometer packs into a leather case with a small bar-magnet, which prevents the needle from too violent oscillations. The same magnet is used to increase or decrease the sensitiveness of the instrument.

"WIRE GAUGE ON BOX," made of German silver, reading to $\frac{1}{1000}$ inch without the use of a magnifying glass. The screw has a pitch of 50 to the inch; to one end of this screw is fixed a tube which represents the drum, divided to 20; the elongated part through which the screw passes has divisions for every turn of the screw, and the drum tube, moving over these divisions, subdivides each part ($\frac{1}{50}$th inch) into twenty, which is equivalent to $\frac{1}{1000}$ inch. This gauge can measure up to a thickness of half-an-inch. When fitted to the top of the box (into which it packs) it leaves the hands free for manipulation.

"DUBOIS RAYMOND'S RHEOCHORD" is simply a set of resistances made up of platinum wires, one of them being variable by a slide moving over it. Generally used in the physiological laboratory.

"SAUNDER'S LIGHTNING DISCHARGER," placed between land line and cable, is of a novel construction. The terminal to which the land line is connected is well insulated on a pillar. To this terminal is fastened a platinum wire $\frac{5.5}{10000}$ inch thick, which passes through a long tube; four pointed screws are placed at each end of the tube, the points being very close to the platinum wire. The other end of the wire is fastened to a spring, the spring proceeding from the well-insulated terminal, connected with the cable. Tube screws and a terminal with a platinum pin, just in line with the wire and behind the spring, are all connected to earth. The lightning, destroying the fine wire, lets the spring press against the platinum pin at its back, and so puts the cable to earth.

HALF-INCH ENGLISH AND FRENCH WIRE GAUGE, WITH TAYLOR'S RATCHET." Similar to the one described above. To read in French measure, a second drum-tube, which surrounds the drum, is fixed to the screw, and slides longitudinally over the latter. The outer drum is divided, so as to subdivide to fractions of a millimetre. The inner drum divides the inch into thousandths. When the French measure is required, the outer drum is pushed over the division of the inner tube; a pin prevents it being pushed too far. The ratchet arrangement prevents too much pressure being put on the gauge.

"MILNER'S FLAT GAUGE." (Fig. 15.) This gauge is entirely different from the others in every respect, and it has the great advantage that in gauging only one hand is required, whilst the others require both hands. The jaws move parallel by a parallel motion; one jaw has an elongation, moving over a number of parallel lines $\frac{1}{10}$ inch apart, running in the same direction as the jaws. The elongation of the movable jaw is bevelled and divided into 20 parts. The zero and the twenty, cut two adjacent parallel lines on the opposite ends when the jaws are measuring $\frac{1}{10}$, $\frac{2}{10}$, &c. The 20 divisions on the bevel subdivide the tenths to fiftieths.

In Milner's circular gauge, on the same principle, but of a simpler and different construction, the movable jaw slides in a tube.

Fig. 16 shows a "SHORT CIRCUIT PLUG," which is of peculiar construction, being specially designed to give a very perfect contact; this is effected by means of a cap which fits over a split tube the two halves of which are respectively connected to the two terminal screws. An ordinary plug in the centre of the cap also makes a contact in the usual way.

Besides the foregoing, a large quantity of miscellaneous instruments are exhibited which it is needless to refer to, as they are of well-known construction, though we may remark that their general design and finish are excellent.

[In our last issue, on page 374, we stated that the "Quadrant electrometer" (fig. 7) gives 100 divisions deflection with one Daniell cell, whilst the Thomson's gives 300; the figures 100 and 300 in this paragraph should be reversed.—ED. *Tel. Jour.*]

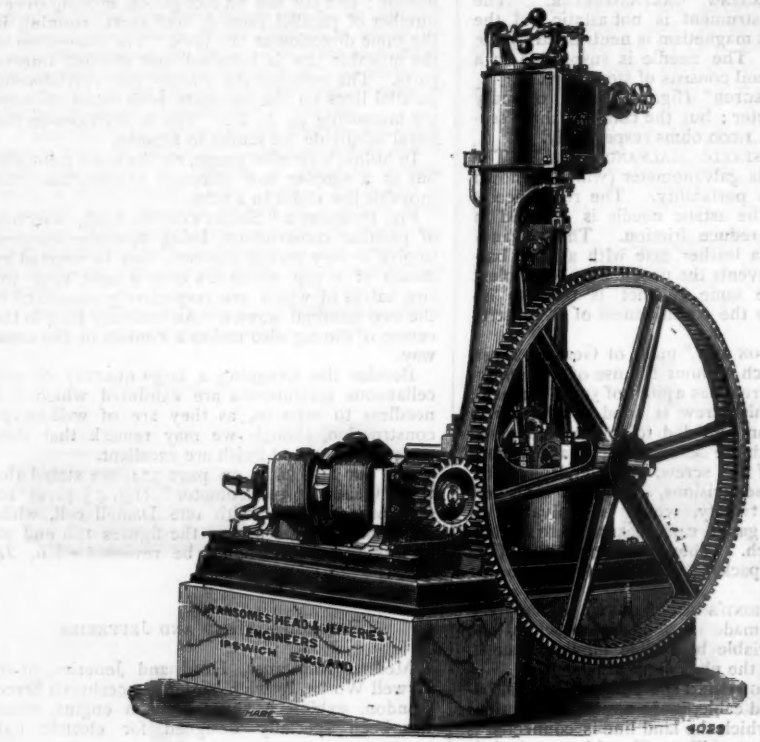
RANSOMES, HEAD AND JEFFERIES.

Messrs. Ransomes, Head and Jefferies, of the Orwell Works, Ipswich, and 9, Gracechurch Street, London, exhibit a vertical steam engine, which has been specially designed for electric light purposes.

The engine (as will be seen from the engraving on p. 396) has a spur fly-wheel for driving the dynamo-electric machine by gearing instead of by strap. This arrangement, which is exceedingly compact, has been supplied by Messrs. Ransomes for use on board steamers, and offers for these and similar situations, where economy in space is an object, very great advantages. The engine is fitted with Messrs. Ransomes' patent automatic governor expansion gear for securing uniformity of speed and economy of steam, and consequently of fuel; and as with the gearing there is no "slip," which sometimes occurs with a strap, especially if at all damp, the number of revolutions required by the dynamo machine can be obtained with perfect accuracy.

The engine, shown on page 396, takes steam from an existing boiler, but they may be had with the boiler complete, if so desired.

Messrs. Ransomes, Head and Jefferies have also another of their engines on the stand of Messrs. L. Clark, Muirhead & Co., of London, which is at work driving the various electric machinery exhibited by this firm. This engine is of ten-horse nominal, of the portable type, similar to that which has been used continuously for nearly three years on the Thames Embankment, and which was illustrated in the number of the Journal for March 15th, 1879. It is mounted on pedestals instead of wheels, and it is also fitted with the patent automatic governor expansion gear already referred to.


RANSOMES, HEAD & JEFFERIES
ENGINEERS
IPSWICH ENGLAND
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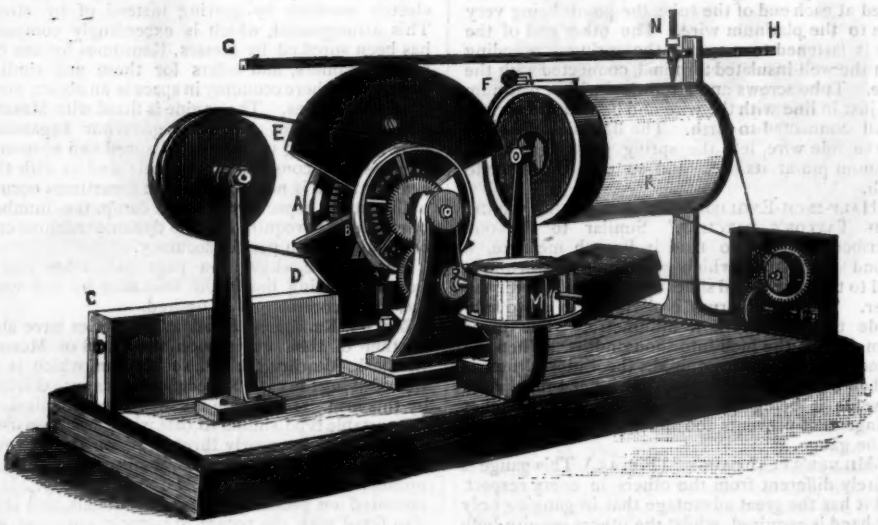
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FREDERICK J. SMITH.

Mr. F. J. SMITH, of Taunton, exhibits a model of an ingenious form of dynamometer for showing at each instant the force transmitted in working any machine.

The leading feature of the design of the machine (which is shown on page 396) is that the spring which is extended by the force transmitted is in no way affected by centrifugal action.

On a shaft carried by two supports are two pulleys, A, B. One is driven by a prime mover, the other drives the machine to be tested; to each pulley a bevil wheel is fixed; these bevil wheels are in gear with a third bevil wheel between them, the axis of which wheel is at right angles to the axes of the former.

The frame which carries the central wheel is capable of any angular displacement, the wheels, of course, being in gear in every position. A spiral spring in the case, C, D, acts at a tangent to the sector-shaped frame which carries the central wheel, so that any difference of pressure between the teeth of the wheels, deflects the arc-shaped piece, E, and moves a light rod, G, H, which records (by means of a glass tracing-point, N) a curve on the drum, K; the area of this curve, as in other recording instruments when interpreted, shows the number of foot pounds transmitted. A lever actuated by an electro-magnet controlled by a pendulum beating seconds, records by means of the pointer, F, the seconds during which any portion of the curve was traced; this is only used when it is required to make a close approximation; without the diagram the deflection is read by a pointer, and the revolutions per minute taken by the counter, M. The machine has recently been so modified in construction, that it is made on one vertical casting, the recording parts being at the top of the wheels.

A small form of the dynamometer has been used in experiments in heat and electricity, and also in connection with a whirling table.

WM. M. FOXCROFT.

This exhibit, which is the only one of the kind in the whole Exhibition, is by that enterprising cabinet work manufacturer Mr. W. M. Foxcroft, of 54, Compton Street, Clerkenwell, London, E.C. It consists of a large number of wooden cases for telegraph apparatus of every description. These cases are very fine specimens of work as regards design and finish, and reflect great credit on the manufacturer. Fig. 1 is a new design for a "Blake's" transmitter and bell case combined, hitherto this has necessitated two separate cases, one for the bell and one for the transmitter, but in Mr. Foxcroft's case the two are combined, the transmitters being in the upper portion, and the work for the bell being under the desk; the bell is placed under the latter with the push just above. Fig. 2 is simply a sample of a bell case for domestic purposes, as shown by Mr. Foxcroft in various woods. Fig. 3 shows a specimen of the well-known "Gower Bell" telephone case. These cases are shown in woods to match the fittings of any mansion or house of business, those of teak are adopted by Her Majesty's Government, for business purposes and for mansions we have satinwood and black, onyx and black,

black and gold, brown, oak, walnut and other fancy woods suitable for the most artistically fitted mansions. Fig. 4 represents a sample of the speaking instrument case (single needle) in use upon the Midland Railway. It is similar to the General Post-office pattern. Fig. 5 is a view of a case for "Syke's" block instrument (*see* "Telegraphic Journal," June 15th, 1880). The wear and tear upon the case being great the simplicity of the design has been necessitated by the strength required. Fig. 6 shows the ordinary block instrument case (single needle) so extensively used by the various railways throughout the world.

design. The "CROSSLEY TRANSMITTER," described in the "Telegraphic Journal," vol. vii., p. 144, is exhibited in various forms, three of which are illustrated in figs. 1, 2, and 3. Fig. 4 represents the early and well-known instrument, which is exhibited at the exhibition, beautifully made up with glass sides, all the working parts being nickeled. Fig. 2 represents a smaller transmitter, combined with a "magneto generator and call-bell," such as are now almost exclusively used in the exchanges both in this country and in America Fig. 1 illustrates an upright Crossley Transmitter, combined with the same style of apparatus and

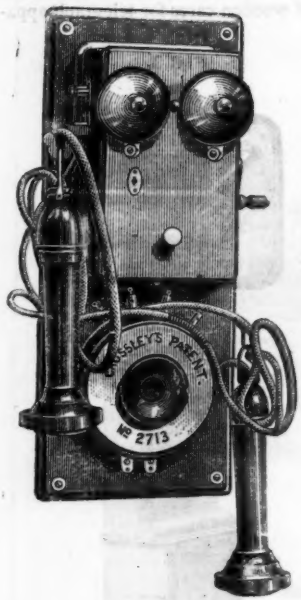


FIG. 1.

FIG. 3

FIG. 2.

FIG. 4.

BLAKEY, EMMOTT & CO.

The exhibits of Messrs. Blakey, Emmott & Co., of the Northern Telegraph Works, Halifax, are very excellent samples of good workmanship and

double telephones. The Crossley Transmitter is also exhibited working in various parts of the exhibition, being connected with the telephone exchanges of the Society General of Telephones and other places. We understand that a company

has been formed to work the Crossley patents in India, Australia, New Zealand, &c. Fig. 3 is a simple magneto call-bell for use with this system.

The "WARBURTON AND CROSSLEY BELL INSTRUMENT" (described in the "Telegraphic Journal" for March 15th, 1880), is shown in working order.

Mr. "KEMPE'S SPEED INDICATOR," which is also exhibited, excites much interest, being connected to one of the engines. This instrument has been described in the "Telegraphic Journal" for May 15th, 1880.

A very good "single needle block instrument," together with "electric bells," "relays," and a "plate electrical machine," are also amongst the exhibits of this firm.

THE EXPERIMENTS OF M. BJERKNES.

By FRANK GERALDY.

As a rule, words must be distrusted: in the first place it often happens that their meaning is ill-defined or that they are not understood by every one in exactly the same manner, which involves the most unpleasant mistakes. But even in the case when they are precise and are received everywhere in one sole acceptation there remains still a danger, that of passing from the word to the idea and of being led to believe that because there is a word there must be some real being designated by that word.

Let us take, *e.g.*, the word electricity; if we understand by this term the common law which connects together a certain category of phenomena it expresses a clear and useful idea; but we have no right to conclude *a priori* from its existence that there exists a distinct agent called electricity which is the efficient cause of these phenomena. We ought, according to the philosophic rule, never to admit beings without absolute necessity. The progress of science has always consisted in gradually eliminating these provisional conceptions and in reducing the number of causes. This is visible without even going back to the ages of ignorance, when every new phenomenon brought with it the conception of a special being by which it was caused and directed. In the last ages we had *spirits*, such as volatile liquids, gases, or even the theoretical conception like phlogiston. At the end of the last century and at the beginning of the present, ideas had already become more sensible. The notion of "fluid" was admitted, a mysterious and somewhat vague category, but still slightly definite. Under this head were arranged the unknown and intangible causes of thermic, luminous and electric phenomena, &c. By degrees the "fluid" vanished and we arrive, or rather we arrived a little time ago, at the notion of "forces"—a precise idea, mathematically comprehensible, but still mysterious in its essence.

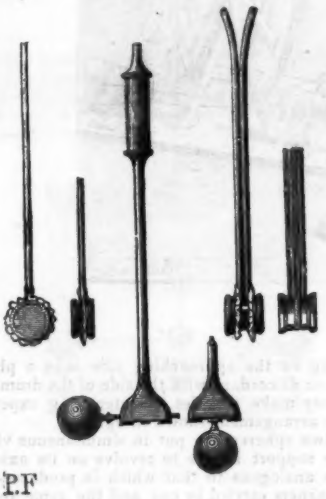


FIG. 1.

Now this conception is gradually disappearing, leaving us merely the elementary ideas of matter and motion—ideas not perhaps much clearer, philosophically speaking, than the others, particularly that of matter considered in itself, but which are at any rate necessary, since all the others pre-suppose them.

Among those notions which study and time have reduced into other and simpler notions, that of electricity should take its place; it presents itself more and more as one of the particular cases of the general movements of matter. This will be the eternal honour of Fresnel that he introduced into science and established mathematically the theory of undulations (suggested, indeed, before him), giving thus the first example of the notion of motion substituted for that of force. Since the principle of the conservation of energy has assumed the prominent position which it now occupies, and since we have seen the continual transformation of one series of phenomena into another the mind is immediately drawn, on witnessing a novel fact, towards an explanation of this kind. Still it is certain that such hypotheses are not easily justified. The motions which we call at present molecular, and which we cannot help assuming as being the source of almost all action, cannot be grasped in themselves, and can be demonstrated only by the coincidence of a great number of consequences. There is, however, another method for rendering them probable, the use of analogy. If we are able to reproduce the effects of electricity by means of vibrations which can be directly demonstrated, there is then reason to admit that electricity is nothing but a system of vibrations, differing merely by special qualities, such as dimension, direction, rapidity, &c.

Such is the result of the very curious experiments due to M. Bjerknes. They form a body of striking results, perfectly concordant and presenting very distinct analogies with electricity as we are about to see.

They depend upon the presence of bodies set in vibration in a liquid. The vibrations which M. Bjerknes produces are of two kinds, pulsations and oscillations. The pulsations are obtained by the aid of small drums, closed by flexible sides, such as are represented on the left of fig. 1. A small cylinder or pump-barrel is connected by means of a tube with this closed chamber, where the rapid movement of a piston alternately aspirates and drives back the air. The two sides are successively pushed outwards and drawn towards the centre. In an apparatus of this kind, the two sides repel the liquid at the same time and attract it at the same time. Their movements are in the same phase, and if it is wished that the one should repel whilst the other attracts, two drums must be set back to back, separated by a rigid partition, must be connected

with two separate pump-barrels, the movements of which are combined in such a manner that one sucks up whilst the other ejects. A system of this kind is to be seen on the right of fig. 1.

The vibrations are obtained by the aid of small metallic spheres fixed in tubular supports of movable levers, to which are communicated the movements of the compression and expansion of the air in the barrel of the pump. They oscillate in a plane, the direction of which, perhaps, varies according to the arrangement of the sphere, as is seen in two apparatus of this kind represented in fig. 1. Fig. 2 gives an idea of the total arrangement.

The two pistons of the air-pumps are joined to connecting rods, so that their phases may be regulated at pleasure, either in coincidence or in opposition. The whole is driven by means of a wheel or belt which renders it possible to obtain rapid vibrations. Caoutchouc tubes conduct air into the apparatus without interfering with its movements.

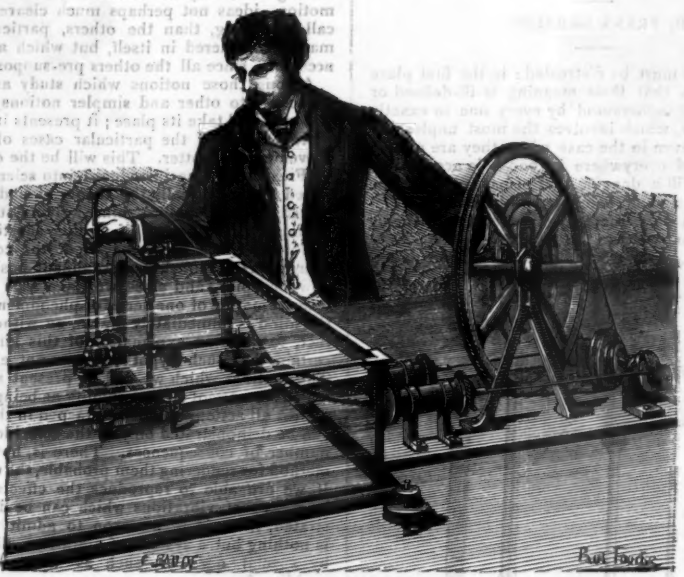


FIG. 2.

We can now enter into the details of the experiments. The first is represented in fig. 2. In a tank of water there is placed a little structure carrying a drum fixed upon an axle and capable of turning. It is, moreover, in communication with one of the air cylinders. The operator holds in his hand a second drum, placed in connection with the other cylinder. The pistons are so adjusted that they move simultaneously; then the sides of the drums expand and contract simultaneously. If the drums are brought near each other, there appears a very marked attraction, the revolving drum following the other. If we adjust the connections so that the pistons work alternately, there is repulsion, so the movable drum recedes from the other. The effect is therefore analogous to that of two magnets, with this difference merely, that the like phases attract and the unlike repel each other, whilst in magnets, like poles repel and unlike poles attract each other.

It must be remarked that the surface of the drum presented is indifferent, since both are in the same phase; the drum behaves, therefore, like an isolated magnetic pole, or rather like a magnet having in its middle a consequent pole. In order to have two poles a double drum is necessary. The experiment is more complicated; two pump-barrels are needed working alternately for this drum alone, and one or two others for the moving drum. The effects are more easily shown with the vibrating spheres, as will be seen directly.

This form has the advantage that the oscillating body presents at once both phases; relatively to the liquid one of its sides advances while the other recedes; thus we may, with a vibrating sphere presented to the moving drum, obtain either attraction or repulsion, according as the approaching side is in a phase accordant or discordant with the side of the drum.

We may make a series of interesting experiments with the arrangement shown in fig. 3.

The two spheres are put in simultaneous vibration and the support is free to revolve on its axis. The effect is analogous to that which is produced by two short magnets carried by one and the same revolving support. On presenting the vibrating sphere to the ends the entire system may be repelled or attracted, according to its phase and the point where it is presented. If we substitute for the transverse support a single sphere, as shown by the dotted line in fig. 3, we obtain the analogue of a short magnet supported upon a pivot, like a small compass. This sphere follows the pole of a vibrating sphere presented to it, as would do the pole of a magnet with this reservation that in the magnet like poles repel each other, whilst with these oscillating bodies, like phases attract each other.

In all the foregoing experiments the bodies brought near each other, are both in motion and the phenomena, resemble those of permanent magnetism. We may also reproduce those which arise from magnetic induction. For this purpose we employ small balls of different materials suspended to floats, as shown in fig. 4 (*a*, *b*, *c*). Let us take, *e.g.*, the body *b*, which is a small sphere of

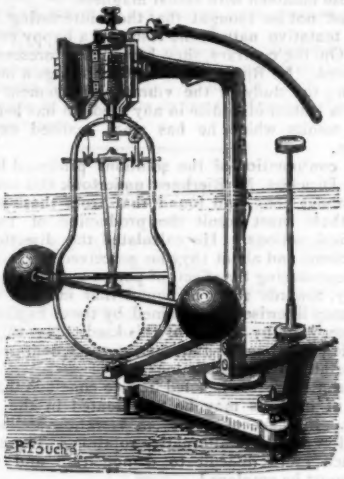


FIG. 3.

metal and present to it, either a drum excited by pulsations, or an oscillating sphere, and it will be attracted, thus representing the action of a magnet upon a piece of soft iron. A curious experiment shows the transition between this new series and the former. If we present

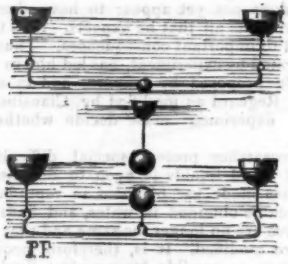


FIG. 4.

to each other two drums in opposite phases, but arranged in such a manner that one of them vibrates much more strongly than the other, on approximating them cautiously, we find that the drum, which has the greater movement, at last exerts upon the author the same action as if the latter were motionless. The effect is analogous to that which takes place between a strong and a weak magnet if their like poles are presented to each other.

On continuing these trials we arrive at a very important point. Instead of the body, *b* (fig. 4), let us take *c*. As the figure shows this is a body lighter than water, and kept in that liquid by a weight. If we present to it the vibrating body it will be repelled, and we obtain the results known under the name of diamagnetism. This experiment brings the influence of

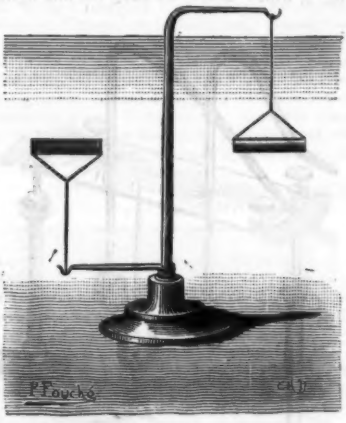


FIG. 5.

mediums into prominence. It is known that Faraday ascribed these effects to the action of the air; he considered that magnetic movements always resulted from a difference between the attraction exerted by the mag-

FIG. 6.

net upon the body experimented upon, and the attraction exerted upon the air. If the body is more sensitive than the air there is direct magnetism; if less sensitive there is diamagnetism. The water between the bodies in the experiments of Bjerknes plays the same part; by its vibration it transmits the movements and determines

the phases of the suspended body. If the body is heavier than water its movement is smaller than that of the liquid, and consequently relatively to the vibrating body it is in the same phase; if it is lighter the contrary is the case and the phases are discordant. These effects can be easily verified by means of the little apparatus, fig. 5, which bears two bars, the one lighter and

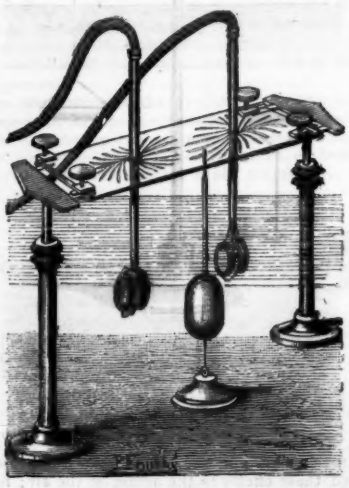


FIG. 7.

the other heavier than water. On approximating the vibrating body to them the one presents its end and takes an axial direction, whilst the other places itself transversely and takes an equatorial direction. These experiments may be varied in sundry manners, upon which it is needless to enlarge as they may be seen at the Exhibition.

We obtain very curious effects also with the arrangement, fig. 6. Between the two drums we introduce a body supported by a float, as is represented in fig. 4 *a*. We may then arrive at different results according to the combinations adopted. Let us suppose that the phases are similar, and that the interposed body is heavier than water; it is then repelled as far as the circumference of the drums, where it stops. If the phases are different the body moves in the opposite direction and stops in the centre.

If the body is lighter than water the effects are naturally modified. If placed between two similar phases it is attracted in a certain radius and repelled if placed at a greater distance. If the phases are opposite it is always repelled. We may easily satisfy ourselves that these effects are analogous to those produced upon bodies placed between two poles of large and powerful magnets. We find here in particular a reproduction of some of the experiments of Faraday. It is needless to repeat that the analogies are always inverted.

M. Bjerknes has carried the examination of these phenomena further and has studied experimentally the action taking place within the liquid. For this purpose he makes use of the arrangement represented in fig. 7. Alongside the vibrating body is placed a light body mounted upon a very flexible spring. It takes the movement of that portion of the liquid where it is placed and by means of a small pencil he writes the direction of the movement upon a plate presented above. On placing this indicator in different directions the whole liquid may be explored. We obtain thus figures quite similar to magnetic figures.

All the cases may be reproduced, the vibrating sphere giving the curves of a magnet with its two poles. We may even show the mutual action of two magnets; the figures are remarkably distinct: if anything more clear than those obtained with actual magnets.

It must not be thought that these interesting facts are of a tentative nature, the result of a happy experiment. On the contrary, they have been foreseen and determined. M. Bjerknes is above all things a mathematician; the study of the vibratory movement of a body or a system of bodies in any medium has led him to the results which he has since realised experimentally.

As a continuation of the solutions produced by M. Lejeune Dirichlet, M. Bjerknes undertook this investigation about 1865, and found that from these movements there must result the production of regular mechanical actions. He calculated the direction of these actions and about 1875 he perceived the possibility of reproducing the effects of permanent magnetism. Recently, towards 1879, he found that induced magnetism may likewise be explained by these hypotheses and represented by actions of this kind. Not till then he made experiments and thus gave a confirmation to the results of his calculations.

The same process has led him to conclude that the action of currents may be represented in the same manner. In place of bodies in vibration bodies are required in a state of alternative rotation. The effects are much more difficult to demonstrate and viscid liquids must be employed.

Nevertheless the experiments have been made. Hitherto the attractions and repulsions have not been exhibited. I do not know if M. Bjerknes has obtained them; but by the means indicated, the lines of action, the electric figures, if I may so express myself, have been traced. They are very curious. If we suppose the current perpendicular to the plate and brought in presence of the pole of a magnet, we see very well the influences produced around it; the figures are especially striking in the case of two currents. M. Bjerknes does not yet appear to have drawn from these experiments all that he expects. Still they have already led to important consequences. Thus calculation, confirmed by experiment, has led him to renounce the formula proposed by Ampère, and to adopt the formula of Regnard as modified by Clausius. More prolonged experiment must decide whether he is right.

These researches present special difficulties, and the use of viscid liquids is open to discussion. M. Bjerknes has made use of them in reproducing the effects which he obtained in water, and finds that the lines of force are no longer the same and that the phenomena are modified. It is, therefore, necessary to depart as little as possible from perfect liquids. The experimenter seeks at present to make use of such liquids in cylinders with fluted surfaces—an expedient not without difficulty.

This series of experiments is a rare instance of the verification of algebraical calculation by direct demonstration. In general we employ geometry, which gives by calculation a graphic representation, furnishing a valuable control; sometimes we have a practical application which is in some respects an important verification, though merely approximative in others. It is exceptional to give, as M. Bjerknes has succeeded in doing, a direct material reproduction, which, whilst it brings the results into a singular prominence, enables

them to be compared with known facts, and to generalise the views upon which they rest.

The hypotheses on the nature of electricity being still but indifferently established nothing which may add to their solidity should be neglected. That electricity is a vibratory movement is perhaps no longer doubtful, but it is not yet as clearly established as in the case of light. Every proof in support of this idea is welcome, especially when it has not been furnished by a kind of accident, but springs from mathematical calculation.

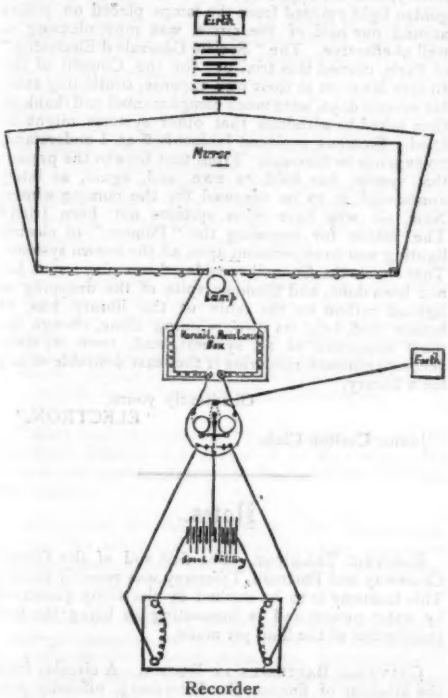
From this double point of view the experiments of M. Bjerknes are very remarkable. I add that they are very curious to see, and I commend them to the examination of all visitors to the Exhibition.—*La Lumière Electrique.*

Correspondence.

RECORDING APPARATUS FOR MIRROR SIGNALS.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—On the 15th ult. I wrote the accompanying letter for insertion in a scientific periodical, inclosing it to a friend of mine who happened to be staying in London for a short time. By the following mail I sent him a drawing and specification asking him to patent



Recorder

my arrangement if I were not forestalled by some one else. In that case I requested him to retain the letter, of which I inclose a copy. On the 14th inst. I received a telegram to say I had been forestalled, and could not patent. I now inclose a duplicate of my former letter, to show that the plan of registering mirror signals by the aid of selenium, has been for some time known to several members of the Eastern Telegraph Company's staff, although neither experimentally tried, patented or published. We may as well claim our meed of credit, though the commercial success be wanting, lest the public should imagine that "they manage these things better in France," or in Belgium. I have heard nothing as yet (beyond my inability to patent) from my friend in London, as he was to sail at once on a cable expedition. I inclose a sketch and description of my arrangement, consoling myself with the satisfaction of evolving a new formula, viz., that the chance of success in invention is inversely proportional to the square of the distance of—one's residence from London.

Yours,

HENRY N. BLACKWOOD PRICE.

Candia, Crete (Turkey in Asia),
Sept. 17th, 1881.

SIR,—I read with great interest in your issue of the 30th ult. that M. Paul Samuel has laid before the Academy of Brussels an apparatus for the purpose of recording mirror signals, by letting the light fall on selenium cells. I am sure that M. Paul Samuel is not the only man by scores who has perceived the advantage derivable from the recording of mirror signals, and that many plans have been devised for that purpose, but without any result which might be considered as a commercial success. Some few years ago the same idea, now brought forward by M. Samuel, occurred to me, and I communicated it to two or three friends, who advised me to bring the matter forward. But for reasons which I shall mention, it became evident that without considerable development the idea was without practical value. For short cables the Morse system is fully satisfactory, especially since the introduction of the relays of Messrs. Brown and Theiler, whose ingenious jockey-armature system neutralises the effect of fluctuating earth-currents and variations of potential, not dependent on the battery current of the sending station. It is therefore only on long cables that a substitute for the beautiful but costly siphon recorder of Sir William Thomson can be used. Various systems have been tried for registering mirror signals; that by means of photography, more than once; but the difficulties of rapid development and fixing of the signals prevent a speed being attained sufficient to make such an instrument a commercial success. Hitherto, unfortunately, the selenium plan has not been more successful than its predecessors, as far as regards long cables, on account of that very moving zero which Messrs. Brown and Theiler have so successfully eliminated in their relays by their jockey armature. Any of your readers who are accustomed to see mirror signals from long cables, will tell you that the spot of light does not return to zero after each signal, but that when three or more deflections on the same side of the scale follow one another (as in the cases of H or 5) without reversal of the current, the spot merely moves a little further up the scale, to the right or left, as the case may be. Thus, with *two* selenium cells, there will be on long cables no distinction of the signals, unless M. Samuel has made some arrangement to regulate the current passing through the relay in proportion to the passage of the spot of light up and down the scale. This I believe may be done by using not merely two, but several pieces of selenium on each side of the zero point, arranged to give rise to a current, of a strength increasing in proportion as the light is distant from the zero point. If this is done we may have not merely registration of mirror signals, but translations on long mirror circuits, and work direct from London to

Bombay, by sea as well as by land. It is only fair to say that the latter plan I have never tried, as my present station, though a very pleasant residence is, as far at least as such experiments are concerned, unsuitable for scientific research. Pardon my trespassing on your space at such length.

Yours, &c.,
HENRY N. BLACKWOOD PRICE.

Candia, Crete (Turkey in Asia),
August 15th.

The arrangement (which is shown by the sketch on page 403) is to be adapted to Sir William Thomson's Mirror, for the purpose of either recording signals, or if necessary, automatically re-transmitting signals to a distant station. The scale of the mirror is composed of a number of pieces of selenium, separated by insulating material, but all joined in the same circuit. When unaffected by light, the two sides should have as nearly as possible the same resistance, but the pieces of selenium are so selected and arranged, that when affected by light each has less resistance in proportion as it is distant from the zero point. Any slight difference in the resistance of the two sides of the scale may be balanced by the resistance box represented in the drawing. It will be seen by the sketch, that the battery current splits between the two sides of the scale, thence goes through the resistance, and through the coils of a Brown's relay (*see* "Telegraphic Journal," May 15th, 1877) differentially wound. Whichever the piece of selenium affected by the light may be, the armature of the relay is affected in exact proportion. The movements of the spot on the scale, whether on opposite sides or on the same one, will always be followed by the closing of a circuit, in consequence of the well-known action of the jockey armature. The closing of the local circuits on each side of the relay may, of course, be made to work either an acoustic, recording, or translating instrument. In place of using a number of pieces of selenium for the scale arranged proportionally, it may be preferred to admit more or less light in the necessary proportions. This may be done by coloured glass, excluding more or less of the greenish-yellow rays, which have the strongest effect on the selenium.

CITY AND GUILDS OF LONDON INSTITUTE EXAMINATIONS.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—Your issue of the 15th inst. contains a letter complaining of the high standard required at the above examinations. I would remind the writer that if the certificates are to be worth anything, the standard must be high; it is a mistake to have it so low that any body can pass with a little study.

A certificate to be of any use should be a guarantee that the holder has a good knowledge of his subject, elementary or advanced, as the case may be.

With reference to the plan of giving twelve questions, all of which may be attempted, I may say that at the examination in May last I answered eight, and obtained a "First Class Advanced," proving that the student need not "hurry through them in such a way that he cannot do justice to himself."

The higher the standard, the greater the satisfaction in passing. To those who have failed I say, "Try again."

J. W. W. B.

September.

ELECTRIC LIGHT.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—In reply to Mr. John E. Chaster's letter in your Journal of the 1st inst.:—the engine on the Thames Embankment drives nightly, and has done so for a long period, 60 Jablochkoff lights, sometimes 70, of over 300 candles naked, and say over 250 in the frosted globes. Twenty horse-power (actual) would drive 30 Jablochkoff lamps, which, yielding, say, 250 candle power globed, would be equal to 7,500; while, according to your correspondent's letter, 20 horse-power (actual) lit 200 Swan lamps, twelve candle power = 2,400, leaving a gain to the arc system of over 4,000. The flickering, as before-named, proceeds from one of two causes, the irregular driving of the engine, high pressure engines with long bands being hardly suitable, or from the pressure of extraneous matter in the carbons used. What your correspondent says touching the inability to test over 150 candle power may, in ordinary cases, be perfectly correct; but the Board of Works in testing the Jablochkoff candle, spent much time and labour, using a photometer invented and arranged by their engineer and chemist; by it they considerably reduced the light power attributed to the candle by the owners of the patent, and I have no doubt that if the proprietors of other systems of electric light require testing as to their lamp's real photometric value, being desirous of not advertising a light power which they do not possess, by application to the Board of Works their desires may be gratified.

Before concluding, a word on the lighting of the British Museum. The first system tried was the Jablochkoff. I was present at the inauguration. Perfect satisfaction was expressed by all connected with the library, and the appearance of the room, with the soft golden light emitted from the lamps placed on pillars around one half of the circle, was most pleasing as well as effective. The "Société Générale d'Électricité," of Paris, carried this trial out for the Council of the British Museum at their own expense, continuing same for several days, were much complimented and thanked; then asked to withdraw that other systems might be tried. Siemens' replaced Jablochkoff at, I understand, no expense to Siemens. From that time to the present that system has held its own, and, again, as lately announced, is to be renewed for the coming winter. Now, sir, why have other systems not been tried? The reason for renewing the "Pioneer" of electric lighting was to experiment upon all the known systems. That course the Council considered fair play; such has not been done, and Siemens, spite of the dropping of lighted carbon on the table of the library, has, as before said, held its own, reigning alone, though the most expensive of all systems, and, from its noisy accompaniments, rendering it the least desirable of any for a library.

Obediently yours,
"ELECTRON."

Junior Carlton Club.

Notes.

ELECTRIC TRAMWAY.—The first sod of the Giant's Causeway and Portrush Tramway was recently turned. This tramway is to be worked by electricity generated by water power, and is interesting as being the first installation of the kind yet made.

GALVANIC BATTERIES IN RUSSIA.—A circular from the minister of finance, St. Petersburg, officially published October 2nd, directs that galvanic batteries, induction apparatus, and insulated wires imported from abroad shall in future be subject to the same rules of inspection and control as are in force for imported arms.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.—The Lord Mayor has convened a meeting at the Mansion House of the honorary council of the international electrical exhibition for Monday, October 24th, at 2.30 o'clock, for the purpose of receiving a report from the directors of the Crystal Palace.

TELEGRAPHIC COMMUNICATION WITH LIGHTHOUSES.—At the request of more than 1,200 of the citizens of London the Lord Mayor has called a meeting at the Mansion House for Tuesday, October 18th, to consider the need of establishing telegraphic communication between lighthouses and lightships and the shores, with a view to prevent, as much as possible, the great loss of life from shipwrecks on our coasts.

ELECTRIC RAILWAY.—The completion and opening of a second electric railway at Berlin will shortly take place.

MEASUREMENT OF THE ROTATION OF THE PLANE OF POLARISATION OF LIGHT UNDER THE MAGNETIC INFLUENCE OF THE EARTH.—By M. H. Becquerel.—It results from the experiments of the author that the yellow rays, D, traversing horizontally a column of 1 metre of sulphuret of carbon at 0° cent. under the influence of terrestrial magnetism at Paris and in a direction parallel to the dipping-needle, undergo a simple magnetic rotation of 0·8697 from the right to the left for an observer supposed to be laid horizontally with his head towards the magnetic north. This number is a natural constant, by means of which it is possible to convert all the determinations of the magnetic rotations of the plane of polarisation of light into absolute measurements, and it also furnishes a means of valuing the intensity of a magnetic field by simply observing the phenomena of rotatory polarisation to which it gives rise. In the system of units, C, G, S, (centimetre, gramme, second) adopted by many physicists the above number leads to the number 1·31 × 10—5 as an expression for the magnetic rotation of the yellow rays through sulphuret of carbon between two points distant from unity in a magnetic field equal to unity.—*Comptes Rendus.*

ON TELEPHONIC LINES CONSIDERED AS LIGHTNING CONDUCTORS.—By M. BÈDE.—The author considers that a line of 100 telephonic wires of 2 millimetres in diameter will be equivalent to a lightning-conductor of 3·14 square millimetres in section and with excellent contacts. If this line passes over a hundred houses it will protect them all equally.—*Le Technologiste.*

L'Electricité pronounces the arrangements of the Electrical Exhibition as regulated by M. Cochery, the French post-master general, to be in defiance of logic and reason.

ACCORDING to the *Zeitschrift für Angewandte Electric*, the telephonic system in Hamburg comprises 150 telephones, but the distinctness of the transmission of sounds is far from perfect.

IN our last issue we stated that the Lachaussée-Lambotte machine and lampes soleil were at present at work at the "Royal Aquarium, Westminster"; this should have been, the "Westminster Panorama."

ELECTRICAL EEL.—Professor Dubois-Raymond has just published an account of the researches of the late Dr. Sachs on the electrical eel (*gymnotus*) of Venezuela.—*Comptes Rendus.*

THE LATE PROFESSOR CLERK MAXWELL.—The delegates of the Clarendon Press will shortly publish an "Elementary Treatise on Electricity," by the late Prof. James Clerk Maxwell, edited by Mr. W. Garnett, formerly Fellow of St. John's College, Cambridge. The book was commenced about seven years ago, but its completion was prevented by the author's other engagements; so that during the last three years of his life very little was added to the work. After his death the first portion of the manuscript, on Statical Electricity, was found in a finished state, as well as some chapters on Current Electricity. The book has been completed so as to cover the subjects included in the first volume of the larger Treatise on Electricity and Magnetism by a selection of some of the simpler articles from the last-mentioned work. As in the larger treatise, the "method of Faraday" has been followed throughout; but no knowledge of the higher mathematics has been assumed, and geometrical methods have been almost everywhere adopted. Very much of the matter contained in the work will, we are informed, be new to readers who had not the advantage of attending Prof. Maxwell's lectures at Cambridge, and the whole book bears indelibly the stamp of Prof. Maxwell's originality. It is as much unlike any other book on electricity as the "Theory of Heat," or "Matter and Motion" is unlike other books on thermodynamics or mechanics. The Clarendon Press likewise have nearly ready for publication a second edition of Prof. Clerk Maxwell's "Treatise on Electricity and Magnetism," edited by Mr. W. D. Niven, Fellow of Trinity College, Cambridge.—*Nature.*

THE ELECTRIC LIGHT AT GODALMING.—The town council of Godalming have accepted the tender of Messrs. Calder and Barret to light up the streets with electric lamps, the current being supplied by machines driven by turbines. The town will ultimately have three Siemens' arc-lamps and forty of Swan's incandescent lights, which will be placed in the lanterns used for the gas-lights. The three Siemens' lamps have been used since Saturday last, and it is expected that the installation will be completed in a week's time. The mills of Messrs. Pullman are also to be illuminated by electricity. The lighting of the town will, it is said, cost 19 per cent. less than the gas estimate, while there will be double the quantity of light.

THE ELECTRIC LIGHT ON BOARD SHIP.—The two Spanish cruisers, *Gravina* and *Velasco*, now approaching completion by the Thames Iron Works and Shipbuilding Company, Blackwall, are to be fitted with large electric lights for "search" purposes, such as are now being extensively employed in the British and many foreign navies.

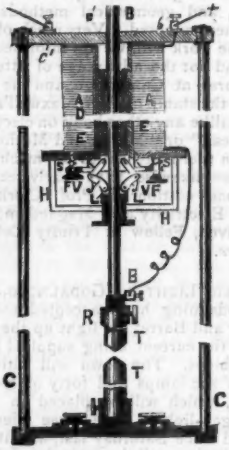
DR. SIEMENS.—Dr. C. W. Siemens has received from the French Government a formal document nominating him "Officier de l'Instruction Publique," the nomination being accompanied by the insignia of the order.

A NEW ELECTRICAL JOURNAL.—A new electrical journal, *Le Moniteur Officiel de l'Electricité*, has lately appeared in Paris.

THE GERMAN UNDERGROUND TELEGRAPH SYSTEM.—The imperial German subterranean telegraph net projected some years ago has been completed. It connects 221 towns and cities, and stretches from Königsberg to Strasburg, from Breslau to Emden, and from Thorn to Aix-la-Chapelle. The first underground cable of the system was laid in March, 1876, from Berlin to Halske,

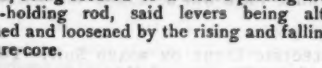
and the last portion of the net, extending from Cologne to Aix-la-Chapelle, was imbedded this summer. The laying of all these cables has taken about 58 months, and cost the empire, in round numbers, about 30,200,000 marks. The total length of the subterranean cables is 5,463,050 kilometres, and that of the wires contained in them 37,372,871 kilometres, 18 of the 23 lines being seven-wired and five four-wired.

ELECTRIC LAMP.—A patent for an electric lamp (No. 246,957, dated June 14th, 1881) has been taken out in the United States by Edward R. Knowles. This lamp, which is shown by the figure, has a magnet connected with the generator of electricity, in combination with a hollow armature-core surrounding the upper-carbon holding-rod, and two compound levers, the



upper arms of which are secured to the armature-core, the lower arms having inner cam-shaped ends to form a clutch, being secured to a sleeve passing around the carbon-holding rod, said levers being alternately tightened and loosened by the rising and falling of the armature-core.

TELEPHONE WIRE TO OVERCOME INDUCTION.—A new kind of wire for overhead telephonic circuits has recently been brought out in the United States by the firm of G. M. Mowbray of North Adams, Mass.; this wire, a small piece of which is shown by the figure,



consists of an insulated core of copper wire (No. 16), sheathed with iron, the two forming a complete metallic circuit. The protective iron sheathing, which envelopes the insulated copper conducting wire, and which forms a split tube, overcomes all inductive interference.

THE MAGNETO-ELECTRIC MACHINE OF C. DUBOIS.—In this machine (German patent, No. 100, 22), the exciting electro-magnets have the form of a wreath or crown. Each electro-magnet consists in the first case of a ring of soft cast iron, made up of round parts surrounded with coils of isolated wire alternating with cheek-pieces in which positive and negative poles are alternately produced, by the battery-current traversing the coils. The action is therefore the same as if two electro-magnets were connected by their corresponding poles. The coils to be induced, fastened to discs of wood, revolve between the electro-magnets. —*Zeitschrift für Angewandte Electric.*

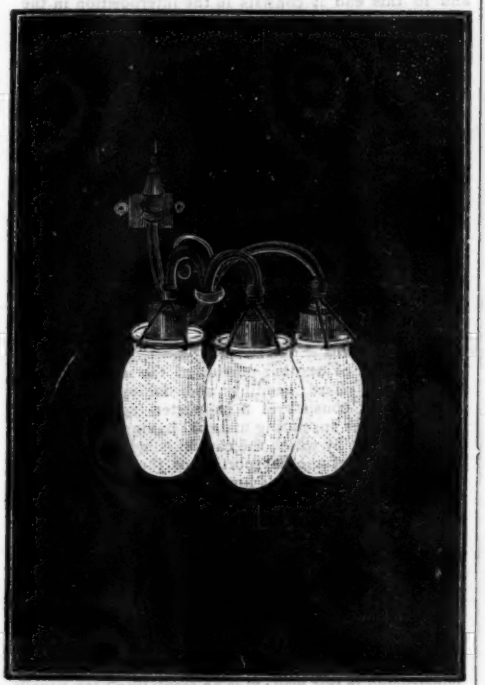
A NEW electric revolving light, to be placed on South Head, Macquarie Harbour, Sydney, was recently exhibited by the makers, Messrs. Chance Brothers, of Birmingham. It is a first-order, dioptric revolving light, with electric arc, and will, when erected in its house, form the most powerful lighthouse in the world —the merging beam from the apparatus being calculated to exceed in luminous intensity twelve million candles. The electric arc, which is supplied by a De Meritens machine, has a power of 12,000 candles, the machine being worked by an Otto engine of eight horse-power.

GRAHAM BELL'S (*sic*) INDUCTION BALANCE.—The *Operator* says:—We have heard nothing lately, by the way, of Professor A. Graham Bell's famous induction balance. That delicate instrument located the ball in the body of our late-lamented President, indicating the front of the right side of the abdomen, just above the groin, as the precise spot. Yet, cold facts, the result of the autopsy, located the ball far away on the other side of the body, and in the back instead of in front. They had better sell out that stock of induction balances.

TELEPHONIC TRANSMISSION OF OPERATIC MUSIC.—One of the attractions at the Paris Exhibition is the transmission of the music from the Opera to the Exhibition every evening. The transmitter employed is a compound michrophone, with pencils and blocks of carbon made upon the Crossley principle, a number of these instruments being fixed near the footlights on the stage. Although this is very interesting, there is really nothing new in the feat, as we described in our columns as long ago as 1879, vol. vii., page 145, some experiments made in the transmission of the services from a church to a distance of some 35 miles by means of the Crossley transmitter. We find, on inquiry, that since we wrote the foregoing, the transmitter named has been regularly employed every Sunday in this useful capacity for the benefit of an invalid, about two miles distant from the church; while often friends of Mr. Crossley's at Saltaire, 15 miles away, also enjoy the privilege of being included in the same circuit. The concerts from the St. George's Hall, in Bradford, have often been transmitted to Halifax, a distance of 10 miles, ever since 1879, for the benefit of audiences at *conversasiones*, &c., in Halifax, and this method of transmitting concerts, &c., has become a regular institution.

THE SAVOY THEATRE.—Mr. D'Oyley Carte gave the opening performance at this theatre on the night of Monday, October 10th. The name originally intended for the building was "Beaufort," as mentioned in our columns previously. The date for the first performance was to have been Oct. 6th, but this had to be altered on account of some delay in getting so large an installation of electric light quite complete. On Monday, the auditorium only was lighted by electricity, the form of the lamps used being shown in the accompanying figure. It will be seen that the clusters consist of three small plum-shaped globes, of slightly ground glass, sufficiently large to inclose the ordinary size lamps of Swan. There are

1,200 of these lamps in the building altogether. The first circle is lit by six clusters of three lamps each, the balcony by 16 clusters of three lamps each, and the gallery also by 16 clusters of three lamps each. In and about the corridors and offices there are many lamps in position, and on the stage are: 1st, footlights of 100 lamps; 2nd, above the stage, five battens



of 100 lamps, and one batten of 50 lamps; 3rd, at the side of the stage, four pilasters of 14 lamps, and two pilasters of 18 lamps each. The apparatus provided for this enormous display are six Siemens' alternating current machines and four exciters; two of the latter (of a large size) excite two each of the alternating current machines, the other two excite only one each. Fowler ploughing engines of 14 horse-power *nominal* were first used as the motive power, but we believe other and more powerful engines will soon be substituted for them.

New Patents—1881.

4165. "Telephone exchange apparatus and systems." E. D. PASS. (Communicated by F. Shaw and W. A. Childs.) Dated September 27.

4168. "Governing apparatus applicable for dynamo or magneto-electric machines, and for the usual forms of electro-motors." W. P. THOMPSON. (Communicated by W. J. Langley.) *Complete.*

4174. "Electric lamps and the manufacture thereof." E. G. BREWER. (Communicated by T. A. Edison.) Dated September 27.

4193. "Electric lamps." C. H. GIMMINGHAM. Dated September 29.

4194. "Apparatus for intermitting audible signals." F. W. DURHAM. Dated September 29.

4202. "Incandescent electric lamps." J. W. SWAN. Dated September 29.

4207. "Dynamo-electric machines." C. A. BARLOW. (Communicated by A. de Meritens). Dated September 29.

4227. "Insulators for animal magnetism." J. LYON.

4255. "Secondary galvanic batteries or electrical accumulators." A. WATT. Dated October 1.

4271. "Electro-magnetic apparatus." W. R. LAKE. (Communicated by A. Dobrochokoff Maikoff and N de Kabbath.)

4294. "Manufacture of incandescent electric lamps." A. G. SCHAEFFER. Dated October 4.

4296. "Conduits or recipients for telegraphic or telephonic conductors laid in streets or roadways." C.D. ABEL. (Communicated by L. A. Brasseur and O. Dejaer.) Dated October 4.

4304. "Dynamo-machines for the production and distribution of electric currents." H. AYLESBURY. Dated October 4.

4305. "Electric lamps." H. J. HADDAN. (Communicated by L. Somzée.) Dated October 4.

4309. "Galvanic or electric batteries." F. WIRTH. (Communicated by J. Stebbins.) Dated October 4.

4310. "Secondary battery." A. P. LAURIE. Dated October 4.

4311. "Electric lamps." J. H. JOHNSON. (Communicated by C. A. Faure.) Dated October 4.

4378. "Railway signals." H. CUTHBERT and G. H. SMITH. Dated October 8.

4383. "Improvements in the manufacture of electric bridges for incandescent lamps and in the means employed therein." ST. G. L. FOX. Dated October 8.

4396. "Manufacture of carbons for electric lamps and apparatus for that purpose." J. JAMES and J. C. F. LEE. Dated October 10.

4398. "Construction of secondary batteries or electrical accumulators." A. W. L. REDDIE. (Communicated by E. Volckmar.) Dated October 10.

4405. "Improvements in and apparatus for producing the electric light and in the manufacture of carbons therefor." A. M. CLARK. (Communicated by Joséphine de Chanzy.)

4409. "Manufacture of telegraph conductors and materials for covering and insulating wire or other conductors used for telegraphic, electric or other similar purposes." W. O. CALLANDER. Dated October 11.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

474. "Galvanic batteries." JOHN CRISP FULLER and GEORGE FULLER. Dated Feb. 4. 2d. According to this invention there is employed in an otherwise complete galvanic element an additional separate porous diaphragm or cell, which is adapted to hold a reserve of the exciting fluid or crystals such as is generally required for the purpose. The invention is more particularly applicable to the bichromic and sulphuric acid batteries. As applied, for instance, in chromic acid batteries the reserve would be chromic acid or bichromate of potash; in batteries in which sulphuric acid is used the reserve would be sulphuric acid; in a Danieli's battery sulphate of copper, and in a nitric acid battery nitric acid. (*Provisional only.*)

497. "Electro-magnetic induction machines. HENRY WILDE. Dated Feb. 5. Consists in a method of constructing electro-magnetic induction machines

with multiple armatures for producing electricity, by which their power and efficiency are greatly increased. In this improvement the metal wheels or discs in which the armatures are mounted are slit in a radial direction towards the centres of each iron armature. The armatures are also slit in a radial direction towards their centres, and are fixed in the wheels in such a position that the slits in the wheels and the slits in the armatures coincide or extend into each other.

539. "Electric lamps." E. G. Brewer. (A communication from abroad by Thomas Alva Edison.) Dated Feb 8. 8d. The object of one portion of this invention is to make a lamp in which the light giving portion is in a straight line in order to give a straight line of light, instead of a circular or elliptical one. To do this the glass neck in whch the carbon is held is extended upward in a vertical arm, so that the lower end of the carbon is held as usual, and the upper end supported by a suitable arrangement at the top of this arm, along which one of the conducting wires passes to

FIG. 1.

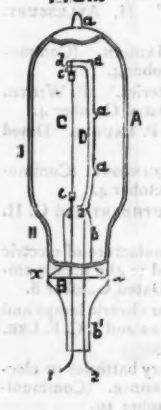


FIG. 4

FIG. 2.

FIG. 3.

the upper end of the carbon. Fig. 1 shows this lamp, in which A is the inclosing globe of glass, preferably cylindrical in shape, with a dome-shaped top, the lower end being drawn into a neck, N. A glass support, B, is made with its lower end fashioned into a supporting neck b^1, the upper part in a bulb, *b*. These parts are united at the line *x*, *x*. Upon the bulb, *b*, is secured a glass arm, D, rising to a little greater height above *b* than the length designed to be given to the carbon to be used, the arm, D, then turning at about a right angle, as shown at *d*. A conductor, 2, is secured to the arm, D, either by being fused therein through its length, or at intervals *a*, *a*, *a*, or by being bound thereto, or in any other convenient manner. The conductor, 2, has at its inner end a clamp, c^1, in which is secured one end of the straight flexible carbon filament, C, whose lower end is in clamp, *c*, upon the inner end of conductor 1. Conductors 1 and 2 pass through and are sealed into *b*.

The object of another portion of this invention is to furnish a device by means of which the light of a single lamp of an electric lighting system may be increased or diminished without affecting any others of the series, and to this end it consists in the interposition in the circuit of the lamp of a carbon resistance, the force of which may be varied at the will of the operator by simply turning a key. This arrangement is illustrated by fig. 2; B is a resistance made of stiff heavy carbon. Attached to it at various points are metallic contacts, *a*, a^1, a^2, &c. The wire, 1, through which the current passes to the light, extends to the metal arm, F, in the centre of the resistance. The current thus normally passes through the wire, 1, the metal arm, F, the contact piece, *a*, and around through the carbon, C, to the wire, 2. But if it is desired to decrease the force of the light the arm, F, may be turned back until it reaches the contact, a^1, thus requiring the current to pass through the portion, G, of the carbon, and interposing so much additional resistance in the circuit. If a still further diminution of the light is desired, the arm may be turned back to the contact, a^2, and the resistance thus doubled, and so on until the whole of the carbon, E, E^1, is included in the circuit 1, 2.

The object of another portion of the invention is to prevent the fibre bending and falling over; this arrangement consists of a supporter (fig. 3) made of glass or other insulating material having a support at its upper end, by which the carbon is held erect.

The object of another portion of the invention is to furnish a different means for retaining a vacuum in the inclosing globe of the lamp. A socket of wood or other insulating material has a glass piece set into it which is somewhat in the form of the letter W, the central arch thereof extending up within the inclosing globe, and having the conducting wires passing through and sealed within it. The inclosing globe sets into this glass piece, both being ground so as to fit tightly together. The remaining space is partly filled with mercury, and a packing of rubber is used to keep the mercury in place. Fig. 4 is a sectional view of a lamp constructed in this way; W is an insulating base, usually of wood; A is the glass socket fitting therein. It is, when seen in section, somewhat of the form of the letter W, the central limb being extended upwardly and forming a support for the wires leading to the clamps, the wires being suitably sealed therein, this central portion extending up within the body of the globe, B. The socket, A, is ground at *a*, and the globe, B, correspondingly ground at *b*, so that they fit tightly together. A space, C, is thus left, which is filled in with mercury forming a liquid seal. Above the mercury is placed a rubber ring, D, which fits tightly and prevents the mercury from escaping. 1, 2, are the wires of the circuit by which electricity is supplied to the lamp. These wires terminate in the platinum clamps, *c*, which hold the carbon. A portion of the circuit is formed by the screw, *d*, which may be drawn back to break the circuit and extinguish the lamp, or *vice versa*.

579. "Electro-photographical receivers for telegraphs." Hippolyte Chameroy. Dated Feb. 10. 6d. Consists of a system of photographing the movements of a mirror galvanometer by making the spot of light act on sensitised paper.

607. "Telegraphic or telephonic apparatus." P. M. Justice. (A communication from abroad by Jacques Victor Michel Bartelous, of Brussels.) Dated Feb. 11. 1s. 4d. This apparatus enables the establish-

ment on a system of three wires, of an unlimited number of subscription stations or telegraphic offices, giving to each the right of calling a central office. By the help of this office the different stations can be put in communication with each other, or with other lines; for the time being all communication on the system is stopped, except between the "caller" and the "called."

639. "Preparing carbon and other conductors for electric lighting." WILLIAM ROBERT LAKE. (A communication from abroad by Hiram Stevens Maxim, of Brooklyn.) Dated Feb. 15. Relates to an improved method or process of preparing carbon or similar material for electric lamps or lighting apparatus, or for other electrical purposes, and is chiefly designed for use with lamps of that class known as incandescent, in which the light-giving portion is a continuous conductor of high resistance, commonly of carbon. The system generally consists in subjecting the carbon conductor while surrounded by an atmosphere of hydrocarbon vapour or other carbonaceous gas to the action of an electric current in the presence of some standard light or other means of determining when the conductor conforms to the standard fixed.

715. "Electric lamps, &c." J. G. TONGUE. (A communication from abroad by Dr. Auguste Lacomme, of Paris.) Dated Feb. 18. 2d. Has for its object improvements in and connected with electric lamps, and also for other lighting and heating purposes, and consists, first, of mounting two or more pairs of carbons or equivalents on an axis, so that after a definite time has elapsed, of a duration nearly equal to the time the carbons will last, the axis and connections receive a partial rotation by means of a current attracting an armature, or by an apparatus driven from the engine, for example, a worm and wheel, or an arrangement of gearing so timed for speed as at a certain point of the revolution to transmit a current to the lamp, and so cause a fresh pair of carbons to appear uppermost, where it is locked until they are nearly consumed, when the operation again takes place. (*Provisional only.*)

774. "Electric lamp." JAMES FYFE. Dated Feb. 23. 2d. Relates to electric lamps in which the regulation of the carbons is effected by means of two solenoid coils, one of which, being of low resistance, is included in the lamp circuit, while the other, being of high resistance, is in a branch circuit connecting the conductors to and from the lamp. The invention consists in certain constructions and arrangements, whereby the regulating coils can be placed at a distance from the carbons. *(Provisional only.)*

785. "Covering wire for electrical purposes." W. E. AYRTON. Dated Feb. 24. 4d. Relates to the covering, and the more compact and orderly arrangement of three or more wires for conducting electrical currents in a more or less parallel direction and alongside each other, by weaving them together with a woof of silk, cotton, or other fibrous material, the wires themselves forming in such case the warp of such web or ribbon; or *vice versâ*, the wires may be the woof, whilst the covering forms the warp.

792. "Electric lamps, &c." PETER JENSEN. (A communication from abroad by Thomas Alva Edison, America). Dated Feb. 24. 6d. Consists, generally speaking, in making the density of the carbons, in incandescent lamps, where a series of lamps are to be used, proportionately greater than that of the standard lamp, their conductivity increasing and resistance decreasing proportionately, so that with the standard amount of energy and the standard amount of electro-motive force or pressure, each lamp of such series shall give the standard amount of light; the radiating surfaces of each remaining approximately at the area of radiating surface of the standard lamp.

844. "Galvanic batteries." FRANK WIRTH. (A communication from Edwin Moriz Reiniger, of the University of Erlangen.) Dated Feb. 28. 2d. Relates to galvanic batteries designed for therapeutic purposes, but is also applicable to other galvanic batteries, and has for its object to facilitate their transport. *(Provisional only.)*

1395. "Electrical apparatus for transmission of sound." W. R. LAKE. (A communication from abroad by Amos Emerson Dolbear, of Somerville, America.) Dated Mar. 29. 6d. Relates to the telephone referred to on page 212 of the No. of the Journal for June 1st.

2256. "Supporting structures for electric wires or conductors," &c. W. R. LAKE. (A communication from abroad by William Clare Allison, of Philadelphia.) Dated May 24. 6d. Relates to supporting structures or supports for telegraphic, telephonic, and other electric wires, and also for electric lamps, and consists in arching the streets from curb to curb, diagonally from the four corners at the intersection of two streets. It also consists in simply springing an arch from curb to curb in the middle of the square, and in certain modifications hereinafter described.

2394. "Electric circuits." SYDNEY PITT. (A communication from abroad by Orazio Lugo, M.D., of New York.) Dated May 31. 6d. Relates to the patent described on page 258 of the number of the Journal for July 1st, 1881.

2593. "Electric clocks." A. M. CLARK. (A communication from abroad by Jakob Schweizer, of Soleure, Switzerland.) Dated June 14. 6d. Relates to an electric clock in which a weight at the end of a lever, which is lifted up periodically by an electro-magnet, drives the mechanism.

City Notes.

Old Broad Street, October 12th, 1881.

DIRECT SPANISH TELEGRAPH COMPANY.—The sixteenth ordinary general meeting of the above Company took place Sept. 30th, at the offices, 106, Cannon-street, Mr. N. Bannatyne in the chair.—(*See* "Telegraphic Journal," Oct. 1.) The chairman, in moving the adoption of the report, said that the results of the working of the past half-year caused them to entertain more favourable hopes of the future of the Company than they had held for some time. He looked with great satisfaction at the addition to the reserve fund, having long maintained that one of the first things to be considered by the directors of a cable company was the establishment of a substantial reserve fund. That was the only thing which could give stability to the property of the company, and render them in the long run independent of those casualties to which a submarine cable was so liable. With regard to their future prospects, he was glad to say that the traffic for the first three months of the present half-year had been highly satisfactory, and they had no reason to doubt that it would be good for the next three months; and if they had no mishap be believed that they would be able to meet them under

more satisfactory circumstances than on that occasion. Their cable and land lines continued to work perfectly, the high electrical condition of the submarine cables showing no variation; and they were in a position to deal satisfactorily with any additional amount of traffic, which he thought it was only reasonable to expect, in consequence of the very improved state of business and matters generally in Spain and elsewhere. One advantage which would result from the improved position of the Company would be that in the future they hoped to be able to pay the dividends immediately after the meetings. Mr. Abraham Scott seconded the motion, and in reply to questions the chairman said that eventually they hoped to be able to invest the reserve fund permanently. It was now, however, in a perfectly safe position, and available within a week or a fortnight. The Spanish Government dealt very fairly with them. They were not bound to pay the Company the money they received on account of the Company till six months afterwards, whereas they generally paid it within four months. The report was unanimously adopted, and the dividends recommended were declared, the meeting terminating with a vote of thanks to the chairman and directors.

GREAT NORTHERN TELEGRAPH COMPANY.—Under date 30th September, we are informed that the Japanese Government lines are again in perfect working order. The Company's lines to China continue to work well.

BRAZILIAN SUBMARINE TELEGRAPH COMPANY (LIMITED).—The accounts of this Company subject to audit show a profit sufficient to enable the payment of a final dividend of 3s. per share, making a total dividend of 6 per cent. for the year ended 30th June, 1881, and also the payment of a bonus of 2s. per share, which together will amount to £32,500, being a distribution in the aggregate of 7 per cent. for the past year, leaving a balance of £54,510, of which amount £50,000 has been placed to the reserve fund, increasing that fund to £345,349; and £4,510 is carried forward.

REUTER'S TELEGRAM COMPANY.—An interim dividend at the rate of 5 per cent. per annum for the half-year ending June 30, has been declared.

SUBMARINE CABLES TRUST.—The coupons due on the 15th inst. will be paid by Messrs. Glyn, Mills & Co.

EASTERN EXTENSION TELEGRAPH COMPANY.—The report of this company states that the gross receipts, including government subsidies, have amounted during the half-year to £191,580, against £173,020 for the corresponding period of 1880, showing an increase of £18,560. The working and other expenses (including a sum of £21,843 for cost of repair of cables and expenses of ships), together with income-tax, absorb £55,230 against £50,384 for the corresponding half-year, leaving a balance of £136,350. From this is deducted £41,595 for interest on debentures, and contributions to sinking funds for the redemption of the Australian Government subsidy and Manila debentures, leaving £94,755 as the net profit for the half-year. One quarterly interim dividend of 1¼ per cent. has been paid, and it is now proposed to distribute another of like amount, together with a bonus of 1s. per share, leaving a balance of £34,830 to be carried forward.

The following are the final quotations of stocks and shares: — Anglo-American, Limited, 52¼-53; Ditto, Preferred, 82-83; Ditto, Deferred, 23¼-23⅝; Brazilian Submarine, Limited, 11⅛-11⅜; Brush Light, ——; Electric Light, ⅜-1; Consolidated Telephone Construction, ⅛-1⅛ A; Cuba, Limited, 9½-10; Cuba, Limited, 10 per cent. Preference, 16-17; Direct Spanish Limited, 5-5⅛; Direct Spanish, 10 per cent. Preference, 16-17; Direct United States Cable, Limited, 1877, 10¼-10½; Debentures, 1884, 103-106; Eastern Limited, 10⅛-10⅜; Eastern 6 per cent. Preference, 13-13½; Eastern, 6 per cent. Debentures, repayable October, 1883, 103-106; Eastern 5 per cent. Debentures, repayable August, 1887, 102-105; Eastern, 5 per cent., repayable Aug., 1899, 105-108; Eastern Extension, Australasian and China, Limited, 11⅛-11⅜; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 107-110; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 104-107; Ditto, registered, repayable 1900, 104-107; Ditto, 5 per cent. Debenture, 1890, 103-106; Eastern and South African, Limited, 5 per cent. Mortgage Debentures, redeemable 1900, 103-106; Ditto, ditto, to bearer, 104-107; German Union Telegraph and Trust, 10-10⅛; Globe Telegraph and Trust, Limited, 6⅛-6⅜; Globe, 6 per cent. Preference, 12⅛-12⅜; Great Northern, 12⅛-12⅜; 5 per cent. Debentures, 103-106; India Rubber Company, 24-25; Ditto, 6 per cent. Debenture, 102-106; Indo-European, Limited, 28-29; London Platino-Brazilian, Limited, 5⅛-6; Mediterranean Extension, Limited, 2⅝-3; Mediterranean Extension, 8 per cent. Preference, 9⅛-9⅜; Oriental Telephone, ⅜-½; Reuter's Limited, 11⅝-12⅛; Submarine, 280-290; Submarine Scrip, 2¾-3; Submarine Cables Trust, 99-103; United Telephone, ——; West Coast of America, Limited, 4⅛-5; West India and Panama, Limited, 1⅞-2; Ditto, 6 per cent. First Preference, 7-7⅛; Ditto, ditto, Second Preference, 6-6⅛; Western and Brazilian, Limited, 7⅛-7⅜; Ditto, 6 per cent. Debentures "A," 110-115; Ditto, ditto, ditto, "B," 98-102; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 125-130; Ditto, 6 per cent. Sterling Bonds, 104-107; Telegraph Construction and Maintenance, Limited, 25-26; Ditto, 6 per cent Bonds, 104-108; Ditto, Second Bonus Trust Certificates, 1⅛-1⅜.

TRAFFIC RECEIPTS.

NAME OF COMPANY.		AUGUST.	SEPT.	REMARKS.
		£	£	
Anglo-American...	1881	..	...	From July the publication of the receipts of this company are suspended.
	1880	..	..	
Brazilian S'marine	1881	11,980	14,841	
	1880	*10,417*	*13,585*	
Cie. Française ...	1881	...	...	
	1880	..	..	Not published
Cuba Submarine...	1881	2,300	2,000	
	1880	*1,886*	*1,710*	
Direct Spanish ...	1881	1,507	1,790	
	1880	*1,197*	*1,857*	
Direct U. States...	1881	...	...	From July the publication of the receipts of this company are suspended.
	1880	..	..	
Eastern	1881	42,797	47,407	
	1880	*40,988*	*41,717*	
Eastern Extension	1881	30,349	30,866	
	1880	*30,169*	*28,771*	
Great Northern ...	1881	21,200	22,280	
	1880	*22,800*	*23,330*	
Indo-European ...	1881	...	...	Not published.
	1880	..	..	
Submarine	1881	...	...	Publication temporarily suspended.
	1880	..	..	
W. Coast America	1881	...	...	
	1880	..	..	
West. & Brazilian	1881	7,745	9,530	
	1880	*7,001*	*9,575*	
West India	1881	3,427	3,964	
	1880	*2,891*	*3,384*	